

NOTEWORTHY PLANT INVASIONS IN THE FLORA OF WESTERN GHATS OF MAHARASHTRA¹

VINAYA S. GHATE²

Plant invasion is the successive and aggressive establishment of exotic plant species in the flora of a region. These invading species by their prolific adaptability replace the elements of the original ecosystem gradually and dominate the area. 40 important invasions in the flora of Western Ghats of Maharashtra are described here. Details regarding country of origin, period of introduction, mode and place of introduction and habitats invaded by the species, as well as control measures, if any, are discussed.

INTRODUCTION

Exotic species following immigration or introduction get acclimatized in the original flora of an area. Some introduced species by their prolific adaptability supported by various natural and man-made agencies, spread very fast, invade large areas and become obnoxious weeds.

Studies on plant invasions are meagre although exotic flora of various botanical regions have been worked out by various scientists like Bruhl (1908), Kashyap (1922-23), Jouget (1928), Biswas (1934, 1941), Srivastava (1954, 1964), Maheshwari (1960), Jain (1963), Santapau (1964), Harlan and deWet (1965), Matthew (1969), Ramaswami *et al.* (1973), Maheshwari and Paul (1975), Haridasan *et al.* (1981), Maiti and Guha Bakshi (1981) and Mukherjee (1981).

Considering the hilly areas of western Maharashtra, studies on exotic flora in general and plant invasions in particular are lacking, except for stray references in floras like Cooke (1903-1908), Santapau (1953, 1957) and many others. An attempt, therefore, was made to explore the region under study for evaluating exotic weed flora. The paper includes observations on 40 important plant invasions in areas of the western Ghats of Maharashtra.

METHODOLOGY

In routine botanical tours in the area under study, special efforts were made to record invasive plant species in various habitats like

protected forest areas, disturbed forest areas, waste lands, water reservoirs and surrounding wetlands, cultivated fields and parks and gardens. Critical notes on life cycle, growth, associated flora and extent of spread of individual species were made in the field. The notes were supplemented by herbarium studies and literature survey.

The results of these studies are compiled in tabular form. The species enumerated in Table 1 are classified under two main heads, namely (i) species introduced purposely but which have run wild and (ii) species which arrived accidentally and have become established. Notes regarding country of origin, period of introduction, mode and place of introduction, and habitat invaded have been included in Table 1.

DISCUSSION

The process of introduction and subsequent naturalisation of foreign plants was initiated some 450 years back with Portuguese settlers in India. In the course of their settlement and stay in Goa, they brought a good number of economically valuable plants from different parts of the world and introduced them in various corners of the country. A large number of other species were unwittingly transported into the country along with the deliberate introductions, and subsequently became included in the flora.

The peculiar terrain of western Maharashtra coupled with varied climatic conditions and heterogeneous vegetational elements provided habitat for these exotic plants. The survival, growth and spread of these introductions was variable depending upon suitability of habitat and

¹Accepted May 1991.

²Department of Botany, M.A.C.S. Research Institute, Pune 411 005.

TABLE 1
ENUMERATION OF SPECIES

A) SPECIES DELIBERATELY INTRODUCED BUT NOW WIDESPREAD

Sl. No.	Species	Nativity/probable period of introduction	Mode of introduction and habitats invaded
1.	<i>Datura metel</i> L.	Tropical America/Before 18th century	Introduced probably for its medicinal use; spread along waste land. Recorded as luxuriant undergrowth in <i>Casuarina</i> plantations along the coast.
2.	<i>D. quercifolia</i> H.B. & K.	America/Early 20th century, 1954	Recorded in 1954. Spreading slowly in waste land.
3.	<i>D. stramonium</i> L.	America/Early 20th century, 1957	Introduced for its medicinal utility. Recorded from 1957, spreading in waste land.
4.	<i>Eichhornia crassipes</i> Solms	Brazil/17th century	Introduced for its ornamental flowers. Now a pest in every aquatic habitat.
5.	<i>Ipomoea carnea</i> Jacq.	South America/Early 20th century, 1921	First reported in south India, as growing in gardens. Spreading very fast, has occupied salt marshes, marshy areas and waste lands.
6.	<i>I. nil</i> (L.) Roth	Tropical America/A century ago	Introduced for its ornamental flowers. Now invading open forest margins, waste land.
7.	<i>Jatropha curcas</i> L.	Tropical America/Before 19th century	Introduced as a fast growing species for afforestation in arid zones. Spreading slowly in open areas.
8.	<i>Lantana camara</i> L.	Central America/Early 18th century, 1809 in Calcutta Garden, 1824 in other areas.	Introduced as ornamental plant for its showy flowers. Widespread in almost all habitats. Major invasion in <i>Tectona</i> forests
9.	<i>Leucaena leucocephala</i> de Wit.	Mexico/ A century ago	Introduced as a fast growing species for afforestation. Commonly adapted in various plantations. Now spreading fast in all habitats.
10.	<i>Opuntia dillenii</i> How.	South America/18th century	Introduced for cochineal industry. Spread everywhere very fast and became a serious pest. Nowadays, controlled growth at a few places. It was controlled biologically.
11.	<i>O. elator</i> Mill.	Mexico/18th century	It was introduced, spread and controlled similarly to <i>O. dillenii</i> .
12.	<i>Pilea microphylla</i> (L.) Liebm.	South America	Introduced as foliage ornamental plant. Spreading as pot weed in parks and gardens.
13.	<i>Prosopis chilensis</i> DC.	Mexico/1877	Introduced as a fast growing species for afforestation programmes in arid zones. Now occupies large areas, particularly open or disturbed forest areas and waste lands.
14.	<i>Ricinus communis</i> L.	Tropical Africa/Early period	Introduced probably for its medicinal utility. Invaded habitats like open barren areas and waste places, particularly near habitations.

Sl. No.	Species	Nativity/probable period of introduction	Mode of introduction and habitats invaded
15.	<i>Tridax procumbens</i> L.	Mexico/1830	Said to have been introduced as ornamental species. Spread as garden escapee and naturalised. Now found everywhere.
16.	<i>Xanthium strumarium</i> L.	Mexico/Before 17th century	Reportedly introduced as a source of medicine. Growing in every habitat type including cultivated fields.
B) ACCIDENTALLY INTRODUCED SPECIES:			
1.	<i>Acanthospermum hispidum</i> DC.	South America/Early 20th century	Introduced along with ballast and packing material of imported goods. Spread mainly along railway lines and thereafter invaded forest clearings and open waste land. Now occupies almost all habitats.
2.	<i>Ageratum conyzoides</i> L.	South America/Late 19th century	Introduced along with foreign packing material. Spread very fast through biotic factors and has occupied almost all habitats including cultivated fields.
3.	<i>Alternanthera pungens</i> HB. & K.	Tropical America/Early 20th century, 1908	Introduced along with baggage and goats. Spread slowly and invaded habitats like open areas and road sides.
4.	<i>Argemone mexicana</i> L.	Central America/Earliest record of 1790	Very early introduction and spread. Invaded habitats like waste land, open forest areas, road sides. Commonly invades disturbed soils.
5.	<i>Cassia occidentalis</i> L.	South America/Before 18th century	Introduced along with foreign goods in very early period. Common element in dry regions along waste lands and barren areas.
6.	<i>Cassia tora</i> L.	South America/Early 17th century	Very common weed of every useful land due to its fast and gregarious growth.
7.	<i>C. uniflora</i> Mill.	West Indies and Tropical Africa/ Very recent in 1980	Introduction recent, spreading very fast. Replacing another obnoxious weed, <i>Parthenium</i> by its gregarious growth. Has invaded waste lands and canal sides.
8.	<i>Chloris barbata</i> Sw.	Tropical Africa/ Late 17th century	Two opinions about its introduction, one that it came by attachment to baggage and second, introduced as fodder grass. Has invaded all habitats including cultivated fields.
9.	<i>Croton bonplandianum</i> Baill.	South America/ 1897 – south India; 1962 – Maharashtra	Introduced with ballasts. Invading marshy habitats.
10.	<i>Elephantopus scaber</i> L.	America/Post Columbian period (Maheshwari and Paul 1975)	Widespread in disturbed forest areas, forest clearings and waste lands.
11.	<i>Eupatorium adenophorum</i> Spreng.	Mexico/Early 1900s	Probably introduced with ornamental plants. Has spread fast and now occupies habitats like road side open places and hilly areas.

Sl. No.	Species	Nativity/probable period of introduction	Mode of introduction and habitats invaded
12.	<i>Euphorbia heterophylla</i> L.	Tropical America/ 17th century	Introduced at a very early period. Invaded all habitats particularly cultivated fields and other cultivable lands.
13.	<i>Gomphrena celosioides</i> C. Mart.	South America/Early 20th century/1964	Although introduced recently in area under study, the spread is fast. Has mainly invaded cultivated lands.
14.	<i>Heliotropium indicum</i> L.	America/About 1500 AD	Introduced along with ballast for baggage. Very common along waste lands and open areas.
15.	<i>Ipomoea triloba</i> L.	Recently in 1954	Probably introduced with ornamental plants. Spreading in gardens and parks and also along roads, waste lands and open areas.
16.	<i>Lagascea mollis</i> Cav.	Mexico/Before 18th century	Naturalised species, has invaded almost all habitats including cultivated lands and forest areas.
17.	<i>Martynia diandra</i> Glox.	Mexico/ 1843	Naturalised species, spread by attachment of its hooked fruits to hair of goats and sheeps. Common on waste land, road sides and open areas.
18.	<i>Oxalis corniculata</i> L.	Europe/1931	Introduced along with ornamental plants. Invading parks, gardens and compounds. Commonly seen in lawns and greenhouses.
19.	<i>O. latifolia</i> Kunth	Mexico/19th century	Introduced with gardens ornamentals and has spread in parks and gardens. Also found in forest clearings.
20.	<i>Parthenium hysterophorus</i> L.	West Indies/1956	Although introduced very recently, has spread widely and invaded habitats like cultivated fields, waste lands and forest clearings. Now an obnoxious weed in cultivated fields.
21	<i>Peperomia pellucida</i> (L.) H.B. & K.	Central America/19th century	Introduced probably with ornamental herbaceous species, now invading gardens, parks and household cultivated areas.
22.	<i>Physalis minima</i> L.	South America/Before 17th century	Has invaded wastelands, forest clearings and dry open areas. Spreads through cattle, birds and other biotic factors.
23.	<i>Portulaca oleracea</i> L.	Europe/Late 19th century	Introduced probably with vegetable seeds. Now growing in moist areas of cultivated lands and also open areas.
24.	<i>Synedrella vialis</i> L.	Mexico/1969	Recent introduction, probably with ornamental plants. Rapidly invading gardens, open places and even forest clearings and open areas.

adaptability of individual species, coupled with natural and man-made factors.

Species like *Datura metel*, *Eichhornia cras-*

sipes, *Lantana camara*, *Leucaena leucocephala*, *Prosopis juliflora* and *Ricinus communis* were introduced deliberately for their utilitarian vir-

tues. These species, with their higher distribution potential, spread rapidly and now occupy various habitats including waste lands.

The highest distribution potential and prolific adaptability is shown by fast invading species like *Ageratum conyzoides*, *Cassia tora*, *Eichhornia crassipes*, *Euphorbia heterophylla*, *Gomphrena celosioides*, *Ipomoea carnea*, *Lagascea mollis*, *Lantana camara*, *Parthenium hysterophorus* and *Prosopis juliflora*. Introduction of these species, particularly that of *Gomphrena celosioides*, *Ipomoea carnea*, *Leucaena leucocephala* and *Parthenium hysterophorus* is very recent, in the late 20th century. The spread of these species, however, is very wide. Species like *Cassia uniflora* and *Synedrella vialis* have been reported to occur in the area over the last 5-7 years. They are also spreading very fast, invading new areas and forming pure stands.

Earlier introductions like *Acanthospermum hispidum*, *Argemone mexicana*, *Croton bonplan-*

dianum, *Heliotropium indicum*, *Jatropha curcas*, *Physalis minima* and *Ricinus communis*, although they have spread to a greater extent in the area under study, do not grow in pure stands as do *Cassia uniflora*, *Eichhornia crassipes*, *Ipomoea carnea*, *Parthenium hysterophorus* or *Synedrella vialis*.

This process of introduction is still active and will doubtless continue indefinitely for the needs of man. However, due care should be taken to avoid future problems that prolific invasions may pose.

ACKNOWLEDGEMENTS

I thank the Director, M.A.C.S., Pune for providing facilities for this work, and Dr M.S. Kumbhojkar, Scientist-in-Charge of the Department and Dr V.D. Vartak for giving me the opportunity to undertake this study and for their valuable suggestions.

REFERENCES

- BISWAS, K. (1934): Distribution of some of the common harmful exotic weeds established in the country. *Indian Forester* 60: 861-865.
- BISWAS, K.P. (1941): The role of foreign plants in the economic life of Bengal. *Sci. & Cult.* 7: 279-284.
- BRUHL, P. (1908): Recent plant immigrants. *J. Asiat. Soc. Beng. (N.S.)* 4: 603-656.
- COOKE, T. (1903-1908): The Flora of Presidency of Bombay. Vols. 1-3. (1958 Reprint). Botanical Survey of India, Howrah.
- HARIDASAN, K., KUMAR, Y. & RAO, R.R. (1981): Enumeration of some important forest weeds of Meghalaya with special emphasis on their role and distribution. *J. Econ. Tax. Bot.* 2: 161-171.
- HARLAN, R.J. & DE WET, J.M.S. (1965): Some thoughts about weeds. *Econ. Bot.* 19 (1): 16-24.
- JAIN, S.K. (1963): Invasion of plants in arid regions of India. *Proc. Nat. Acad. Sci. India. Sect. B.* 33(1): 58-60.
- JOUGET, H. (1928): Weeds of Indian way side. *J. Bombay nat. Hist. Soc.* 32: 810-812.
- KASHYAP, S.R. (1922-23): Notes on some foreign weeds that have established themselves around Lahore. *J. Indian Bot. Soc.* 3: 68-71.
- MAHESHWARI, J.K. (1960): Studies on naturalized flora of India. *Proc. Summer School in Botany (Darjeeling)*. pp. 154-170.
- MAHESHWARI, J.K. & PAUL, S.R. (1975): The exotic flora of Ranchi. *J. Bombay nat. Hist. Soc.* 72(1): 158-188.
- MAITI, G.G. & GUHA BAKSHI (1981): Invasion of exotic weeds in West Bengal since 1903: Dicotyledons and Monocotyledons. *J. Econ. Tax. Bot.* 2: 1-21.
- MATTHEW, K.M. (1969): The exotic flora of Kodaikanal, Palni Hills. *Rec. Bot. Surv. India*, 20(1): 1-241.
- MUKHERJEE, A.K. (1981): Distribution potentiality and plant introduction. *J. Econ. Tax. Bot.* 2: 277-229.
- RAMASWAMI, S.V., RAO, R.R. & BHASKAR, V. (1973): Notes on adventive plants of Bangalore and Mysore Districts. *J. Mysore Univ. Sect. B* 26: 40-60.
- SANTAPAU, H. (1953): The Flora of Khandala on the Western Ghats of India. *Records of Botanical Survey of India* 16 (1): 1-369.
- SANTAPAU, H. (1957): The Flora of Purandhar. Oxford Books and Stationery Co., New Delhi.
- SANTAPAU, H. (1964): These exotic weeds need watching. *Indian Farming* 14(4): 23.
- SRIVASTAVA, J.G. (1954): Some recently introduced or newly recorded plants from Patna District and its neighbourhood. *J. Bombay nat. Hist. Soc.* 53: 659-660.
- SRIVASTAVA, J.G. (1964): Some tropical American and African weeds that have invaded the State of Bihar. *J. Indian Bot. Soc.* 43(1): 102-112.